REMOVABLE ELECTRONIC MODULE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to connection of a removable electronic module and, more particularly, to a connection which can occupy less space than conventional removable electronic module connections.

2. Brief Description of Prior Developments

Electronic module readers, such as a memory card reader for example, are provided in portable electronic devices, such as mobile telephones, digital cameras and hand-held games, for example. The readers allow a user to removably insert different modules for use by the device. In the past, the some readers were provided with a first switch for detecting the presence of a memory module in the reader. The reader could also have a separate second switch for signally a pre-warning if the module was being removed or ejected from the reader. This second switch was to allow for "hot swapping" of modules without having to turn OFF power to the device.

U.S. Patent Publication No. 2006/0273174 A1, which is hereby incorporated by reference in its entirety, discloses an electronic module reader with a module detection and ejection pre-warning switch. U.S. Patent Publication No. 2004/0043643 A1, which is hereby incorporated by reference in its entirety, discloses peripheral leads on an electrical interconnect. U.S. Patent Publication No. 2006/0143352 A1, which is hereby incorporated by reference in its entirety, discloses an electronic device having a memory card detachment/attachment recognition function and method.

There is a desire to make thinner mobile phones and other hand-held portable electronic devices. Height of the memory card reader mechanics is one limiting factor for creating thinner designs. The main reason for this height problem is that the contacts of the card are under the card (the bottom side of the card) which forces the reader design to be implemented under the bottom of the card. For good and reliable connection the reader needs to be implemented with spring contacts, and they are located under the card. This increases the height of the assembly. Another factor increasing the height of the assembly is the additional mechanics to detect card removal information. There is a desire to reduce the height or thickness of a card and card reader assembly to thereby enable design of thinner electronic devices, such as mobile phones for example. Conventional designs for card removal and detection also add complexity of design mechanisms. This increases costs and may be prone to failure. Thus, there is also a desire to reduce complexity of card removal and detection.

SUMMARY OF THE INVENTION

In accordance with one aspect of the invention, an electronic module adapted to be removably, operably connected to an electronic device is provided. The electronic module includes a housing; at least one electronic component in the housing; and a plurality of electrical contact areas. The housing has a general electronic card shape with relatively large top and bottom sides and relatively thin side edges between the top and bottom sides. The plurality of electrical contact areas are located on a first one of the side edges. The electrical contact areas are connected to the at least one electronic component such that, when the electronic module is operably connected to the electronic device, the electrical contact areas on the first side edge are adapted to electrically couple the at least one electronic component to the electronic device along the first side edge.

In accordance with another aspect of the invention, an electronic module adapted to be removably, operably connected to an electronic device is provided. The electronic module comprises a housing; at least one electronic component in the housing; an electrical contact area; and a removal detection system. The housing has a general electronic card shape with relatively large top and bottom sides and relatively thin side edges between the top and bottom sides. The electrical contact area is located proximate a first end of the housing for electrically coupling the at least one electronic component to the electronic device. The removal detection system is adapted to detect when a user is initiating removal of the electronic module from the electronic device. The removal detection system comprises a user input on one of the side edges of the housing at an opposite second end of the housing.

In accordance with another aspect of the invention, an electronic module adapted to be removably, operably connected to an electronic device is provided. The electronic module includes a housing; at least one electronic component in the housing; an electrical contact area proximate a first end of the housing for electrically coupling the at least one electronic component to the electronic device; and a user input at an opposite second end of the housing. The user input comprises an electronic touch sensor adapted to send an electrical signal when a user touches the touch sensor with a finger.

In accordance with another aspect of the invention, a method of detecting initiation of removal of a removable electronic module by a user from an electronic device is provided comprising providing the removable electronic module with a sensing system to sense when a user is initiating removal of the electronic module from the electronic device, wherein the sensing system comprises a user input; sending a signal from the user input when the user has activated the user input; and determining when a user has activated the user input of the electronic module at least partially based upon receipt of the signal by an electronic component of the electronic module.

In accordance with another aspect of the invention, a method of detecting initiation of removal of a removable electronic module from an electronic device is provided comprising providing the electronic module with a touch sensor which is adapted to sense when a user touches the touch sensor and generate an electrical signal; and sending the signal to a shut down system for at least partially terminating use of the electronic module by the electronic device before removal of the electronic module from the electronic device.

In accordance with another aspect of the invention, an electrical connector is provided comprising a housing; a resilient member mounted in the housing, wherein the resilient member comprises electrically non-conductive flexible material; and a plurality of substantially rigid electrical contacts mounted to the resilient member. The electrical contacts each comprise a first side having a first contact area which is adapted to contact a removable electronic module and a second side, which is offset about 90 degrees from the first side, and which is adapted to contact a second contact area on an electronic component.

In accordance with another aspect of the invention, a program storage device is provided which readable by a machine, tangibly embodying a program of instructions executable by the machine for performing operations to detect initiation of removal of a removable electronic card from a card reader, the operations comprising: determining when a user has touched